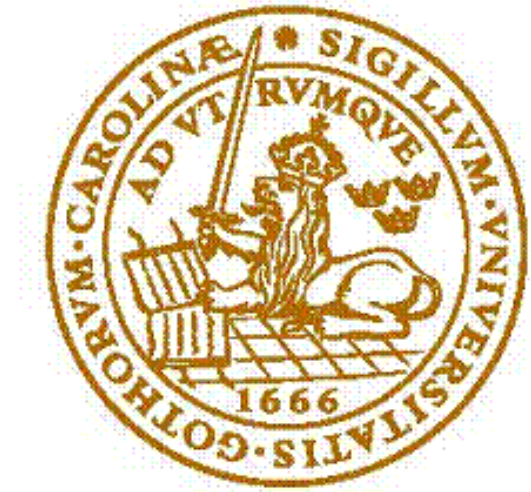
Master Thesis

The Effects of Weather on Swedish Stock Return



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Abstract

Based on the special location and weather condition of Sweden, this paper investigates the empirical association between stock market return and multi weather factors. (i.e. cloud cover, temperature, air pressure, wind speed ,precipitation and snow),along with the effects of seasonal affective disorder (SAD) that is related to shortened daytime length. Overall, our major results suggest that there is a salient correlation between temperature and stock returns of big-scale companies. Small-scale companies tend to be affected by multi weather factors but no clear pattern is observed.

Key Words: Behavioral finance; Seasonal affective disorder; Stock market return; Weather.

Contents

1.Introduction

1.1 Background

It is well-known that the traditional financial theory holds under the efficient market hypothesis (EMH), where rational investors will evaluate and choose the optimal portfolio applying the “capital asset pricing model” (CAPM) (Sharp, 1964) and the “theory of portfolio” (Markowitz, 1952), making trade-off between the expected risk and return in a mean-variance theoretical efficient system.

However, evidence show that investors, either individual or institutional, given different attitudes towards risk, tend to be affected by a variety of environmental factors and so that behave irrational when they are reacting to the information on the market and in the process of decision-making. (Kahneman and Tverkey, 1979) At the time, the application of behavioral finance shed some lights on explaining the imperfections of the traditional financial theory.

1.2 Problem discussion

Over recent years, the significance of psychological factors of investors is obtaining increasingly attention on investigating the market returns and trading activities. Among the psychological factors that have been taken into consideration, the affection of multi weather factors plays an important role in investor decision-making process and risk attitude and therefore stock market return. Evidently, weather influences individual’s moods or emotional states and thereby influencing our daily life in every aspect. (Haward and Hoffman(1984); Symeonidis (2010)) Subsequently, it will affect investor’s assessment of risk and investment behavior. For instance, Schwarz and Clore (1983) found that people tend to have much higher satisfactions to their daily lives on sunny days even if they are not really affected by the good weather physically. It is understandable that investors tend to hold optimistic expectations

towards their future prospects on stock market at the time they enjoy good mood as a result of good weather. (Daniel et al, 1998; Hirshleifer 2001) In addition, as a consequence of seasonal affective disorder (SAD), people become more risk-averse during winter time when the day time length is relatively shorten and when they are in the condition of depression. (Kamstra et al, 2003)

Given the salient effects of weather variables that have been observed in previous studies, we consider that the effect of weather on stock market return is a topic worth to be investigated.

1.3 Purpose

As a Scandinavian country, the weather specification of Sweden is noticeable. Moreover, due to the high latitude that Sweden located, the feature of day time length is of substantial significance.

Motivated by the various empirical results from different parts of the world on the effects of weather factors on the local stock market, in this thesis, we aim to investigate the effects of multi weather factors including biorhythms (i.e. seasonal affective disorder) on Swedish stock market return, which will initially present a comprehensive picture for the weather effects on Swedish stock market.

1.4 Outline

The paper is organized as follows: Section 2 reviews the findings on previous literature. Section 3 describes the data that have been chosen. Section 4 applies the methodology on data base to investigate the correlation between weather factors and Swedish stock market in different aspects and investigates the affection of daytime length on stock

market return.Section 5 shows the empirical results and analysis the results obtained. Section 6 is conclusion.

2.Literature review

The relationship between weather, mood and decision-making process of investors and hence stock market return has been a frequent topic of discussion. The behavioral effects of weather on stock market have been taken into account by financial professionals for a long time back from nearly a century ago. Nelson (1902) states that investors are affected by psychological factors so much that they do not behave rationally and trade confidently during stormy and wet days as they do in sunny and dry weather. More recently, Cunningham(1979); Sanders and Brizzolara (1982) ; Howarth and Hoffman (1984) have established profound empirical evidence that weather influences moods and attitudes of investors.

A variety of findings of former researches will be presented in this part in order to build the connection between weather factors, mood, decision making process, risk attitudes and therefore stock market return.

2.1 Weather and mood

It is well-acknowledged that the daily life of human being is affected by various environmental factors and among which, weather factors that intuitively influence individual's mood are of particular importance and have been of extensive interests.
Apart from the physical impact, a series of researches have been conducted to find the connection between weather factors and individual's mood.

Back to the early 1970s, researchers have confirmed a relationship between weather and temperament. A low mood is related to high humidity and less exposure to sunshine, while higher barometric pressure and sunny weather tend to uplift people's mood. By studying on 24 college students using mood questionnaires over 11 consecutive days, Haward and Hoffman (1984) found a significant effect on mood that is correlated with the weather. They stated that temperature, humidity and daytime length have the greatest effects on mood. Cunningham (1979) suggested that sunny and clear days will predict a good mood. Meanwhile, the level of temperature has a positive (negative) correlation with mood in summer (winter). Redelmeier and Baxter (2009) found that on sunny days the average score of college students was 10% higher than that on rainy days, while Symeonidis et al (2010) stated that cloud cover is a weather factor that influences mood.

2.2 Mood, decision-making and risk tolerance

A large body of literatures studied on how human's moods affect the decision-making process and the attitude towards risk. Etzioni(1998); Romer(2000) and Mehra and Sah(2002) established the significant role of mood in decision-making process, on the basis of the theories that studied by Schwarz(1990) and Loewenstein et al(2001) who link emotions and feeling to general decision-making.

As suggested by Isen(1993), when people is in the condition of a good mood, the cognitive processes will be simplified and thereby accelerating the process of making a decision. Hirshleifer and Shumway (2003) stated that this cognitive processes that are affected by good mood will simplify complicated information effectively. Forgas et al (2009), on the other hand, found that negative emotions that induced by weather tend to enhance the accuracy of memory.

Some researches also show that people's attitudes towards risk are influenced by changes of emotions. Mehra and Sah(2002) found that even small fluctuations of risk

evaluation of investors can have a non-negligible influence on decision-making and thereby on stock market. Cao and Wei(2004) stated that aggression, which is caused by lower temperature, could lead to more risk-taking while apathy, which is related to higher temperature, tends to impede risk-taking.

2.3 Weather and Stock market return

Given the link between weather, mood, decision-making and risk tolerance that have been discussed above, the relations between weather and stock market return have been explored on the basis of different weather factors and countries or regions all around the world.

Saunders (1993) was the first that proposed the linkage between investor behavior and weather condition factors by examining the correlation between stock returns on New York Stock Exchange (NYSE) and the cloud cover in Manhattan during the period of 1927 to 1989. A negative correlation has been found, i.e. stock returns tend to be higher when there is less cloud cover in the region of Manhattan and the difference on stock returns on the least cloudy days and most cloudy days is statistically and substantially significant. These findings confirmed the conjecture that optimistic moods of investors as a result of sunny weather contribute to the rise of stock returns while the pessimistic moods caused by cloudy weather depress the stock returns. Further, .Hirshleifer and Shumway (2003) extended the finding of Saunders (1993) and found supporting results of a negative correlation between cloud cover and equity returns while sunshine is significantly related to stock returns in 26 international stock markets.

As the significant correlation between weather condition and stock market receives increasingly attention, multi weather factors besides cloud cover have been examined

in recent studies. Cao and Wei (2004) explored the correlation between temperature and stock market returns on the basis of the psychological evidences that lower temperature can cause aggression while higher temperature induces both apathy and aggression. Given the conjecture that aggression leads to more tolerance towards risk while apathy may result in risk-averse, they found a statistically significant negative correlation between temperature and returns across the whole range of temperature by analyzing world-wide stock markets. By studying the evidence of New Zealand using local weather factors and financial securities of New Zealand, Keef and Roush (2003) found significant effect of wind speed on the returns.

Another perspective to investigate the effects of weather is to focus on specific country or region given considerably different weather conditions across the world. Some of the studies show salient correlation between one or several weather factors and stock market, while some give rise to contradictory results.

By studying on the evidence from Nepalese Stock Market, Bhattarai and Joshi (2007) obtained weakly relationship between temperature, seasonal affective disorder and stock returns, but not for cloud cover. Based on the weather factors and stock indices from Australia, Keef and Roush (2007) found that stock returns are negatively influenced by the temperature in Sydney though no correlations are found between stock returns and both wind speed and cloud cover. Yoon and Kang (2009) explored the interaction effects of three weather factors (i.e. temperature ,humidity and cloud cover) and stock market returns in Korean before and after the 1997 financial crisis and draw the conclusion that weather effects were weakened due to the improvement of stock market efficiency. In China, focusing on the special features of Shanghai Stock Exchange, an order driven market compared to quote- driven market where the behavior of market makers plays an important role in deciding the market activities, Lu and Chou (2011) states that generally environmental influences that related to psychological factors tend to affect trading activities rather than stock returns. Similar studies have been conducted by Tufan and Hamarat (2004) for the Istanbul stock

exchange and Krämer and Runde (1997) for the German stock index, which lead to various conclusions based on the specific market.

By analyzing the different and sometimes contradict empirical results obtained in different countries and regions of the world, it is naturally to come to the conjecture that whether any of the multi weather factors are influencing the stock market and if so, to which extent they are influencing the stock market is highly related to the local market of the country or region that has been chosen.

In conclusion, by taking both special weather condition of the region and the specific feature of the selected market into account, a variety of weather effects on stock market return have been addressed in previous researches.

2.4 Seasonal affective disorder (SAD) and SAD effects

Known as an extensively studied medical condition, SAD, which stands for seasonal affective disorder has raised awareness among researchers who engage in investigating the correlation between environmental factors and financial markets.
Although various factors could be connected to the incidence of SAD, clinical researches in medicine and psychology have suggested that diminished level of daylight in fall and winter days is the primary cause of SAD.

According to Molin et al (1996), reduced length of daylight will cause seasonal depression and this effect is more pronounced in countries and regions that in extreme latitudes. Further, supportive evidence in psychology shows that SAD is responsible for individuals' propensity of taking risk. Depression that caused by shorter level of daytime is found to be related to heightened risk aversion and hence lowered risk-taking behavior.

Given the risky nature of financial market, it has been of growing interest on the influences of SAD that may insert on the market. It is not unreasonable to conjecture that investors that affected by SAD and thereby less risk tolerance require higher expected rates of return on their portfolio. They tend to shun risk by investing more in safe assets and less on risky assets, which will result in lower return in the stock market when the daytime length is shorter. As the daytime length resumes, higher returns on the stock market are expected due to the change of attitudes and behaviors of less risk-averse SAD-affected investors.

Kamstra,Kramer and Levi(2002) initially link the seasonality of stock market return with the level of daytime length by analyzing numerous data from international stock markets, controlling for the well-known market seasonal and other environmental factors. Statistically and economically significant seasonal patterns have been found and this result has been termed SAD effects. Moreover, they confirmed that the SAD effects are more prominent in markets that located in higher latitudes while results in the Southern hemisphere, on the other hand, are six months out of sync, which consistent to the seasons.

By studying the seasonality of treasure market, an opposite pattern has been found by Kamstra Kramer and Levi (2008). They confirmed that government bond, which is considered as safe investment, is preferred by SAD-influenced investors when the daytime length is short and when they are less risk tolerant.

Based on the longstanding acknowledge of SAD and the common extreme weather evidence in Sweden, we reckon that the effects of SAD on Swedish stock market is a fair example to study.

2.5 Expectation

Based on the previous literature that has been discussed above and take the specific weather condition of Sweden into consideration, we have some certain expectations regarding the result.

For the effect of cloud cover, we expect to reach the same result as previous studies, where stock returns rise with the decrease of cloud cover rate; stock return is expected to move negatively with wind speed and positively with air pressure due to the favorable weather condition that is linked to higher air pressure. Being considered as extreme weather conditions, rain and snow variable is also expected to affect to some extent but no clear pattern is expected.

Regarding temperature, we consider that the special weather fact of Sweden region has to be taken into account as a determinant factor. Located in the very north of Europe, the temperature in Sweden as a whole is fairly low on average compared to most of the countries in Europe and in other parts of the world. Therefore, the effect of mood and risk-taking behavior induced by high temperature may not applicable in our case. Conversely, parts of Sweden suffer from relatively low temperature in winter. Therefore, unlike previous finding on other stock markets, we expect to observe a positive relationship between stock return and temperature on Stockholm stock market.

As has been mentioned before, the appearance of SAD effect on Swedish stock market is also an important expectation that we hold towards the expected result due to the high latitude that Sweden is located.

3. Data Description

To explore the relation between Swedish stock market return and multi weather variables, both stock returns and weather data are employed and are described as follows:

3.1 Weather variables

The weather data is collected from climactic database of Chinese Academy of Sciences (CAS)[1]. The Chinese academy of Sciences is a professional academic institution in China and the CAS's database includes specific weather data at plenty of locations around the world. In most of CAS locations, it reports temperature, cloud cover, atmospheric pressure, wind, rain precipitation, sun duration and snowfall on hourly basis.

In this paper, the variables below for the period 1st January 2000 to 31st December 2010 at Stockholm area are considered: Cloud cover, temperature, air pressure, wind, snow, rain, Monday effect, SAD.

Choosing the variables above depends on both the local weather conditions of Sweden and the availability of data. Temperature, air pressure and cloud cover are basic weather variables and they are typical chosen variables of this topic. Considering the specific weather phenomenon of Sweden, we also reckon wind, snow, rain and SAD variables will be of great interest. We aware that in previous studies, some other variables (e.g. humidity, visibility, tide, phase of moon) have also been examined, however, these variables have been used by few researchers and no standard conclusion have been reached in our best knowledge. We thereby do not

[1] http://english.cas.cn/

consider these weather factors.

The multi weather data that have been chosen are described as below:

Cloud cover

Referring to Sauders (1993), cloud cover rate is measured by rating approach as: 1=sunny; 2=sunny and cloudy; 3=cloudy; 4=overcast (or drizzle); 5=rain (or snow or mist). Transform these five levels to a numerical way as: cloudy rate 0-10% =level 1; cloudy rate 10-30% =level 2; cloudy rate 30-50% =level 3; cloudy rate 50-80% =level 4; cloudy rate 80-100% =level 5.

Higher rate of cloud cover result in extreme weather conditions, i.e. rain and snow. In this paper, rain and snow conditions will be considered as dummy variables in the regression model.

Rain and Snow

According to Lu & Chou(2011), the same measure is applied to rain and snow to set them as dummy variables. During our test periods when it is rain, RAIN=1, and 0 otherwise; in the same way, when it is snow at certain day t, SNOW=1, and 0 otherwise.

Temperature

Temperature is an important weather factor that affects human mood and behavior. In general, when the temperature is between 20 degree to 22 degrees Celsius, people tend to have comfortable feeling and therefore work more efficiently. However, when the temperature is greater than 34 degrees Celsius, not only the feeling of irritability is easily to be triggered, but also ultra-activity and depression tend to occur. On the contrary, low temperature will also bring forth negative mood. When the temperature drops to below 10 degrees Celsius, people's mood is dull and inexplicably low; further, when the temperature is below 4 degrees Celsius, people's efficiency of

thinking will be severely damaged. It is no doubt that the majority of trading behaviors happen indoor and therefore isolate from the temperature outside. However, the influence of the outdoor temperature is unavoidable as investors transport to working place and this effect could remain exist for some time after they reach indoor. Thus, temperature will be taken into account in this paper.

The temperature data employed in this paper is measured at 2 meters from the ground temperature and is recorded as degrees Celsius.

Wind speed

Apart from temperature, wind velocity is another important factor that is directly related to the feeling of people. A gentle breeze brings comfortable feeling and enhances people's spirit; while sustained heavy winds cause discomfort and hinder the normal breath(Michael R. Cunningham 1979). Therefore, wind speed variable will be taken into account.

Stathopoulos (2009) pointed out that no obvious feeling is sensed when wind speed is less than 5km/h. Thus, in this paper, wind speed is set as a dummy variable. When the wind speed is faster than 5km/h, it is set to 1, and 0 otherwise.

Air Pressure

Air pressure is known a as a fair predictor of weather and is considerably linked with human health and thereby affecting people's mood and behavior non-negligibly. Empirical evidence shows that, in general, higher air pressure predicts sunny and warmer weather while low air pressure is usually a forecast of cloudy and rainy day.[2] According to Steven M. Boker, Ellen Leibenluft,etc (2008), air pressure affects human being both physiologically and psychologically. For instance, under low pressure which may lead to cold and rainy weather, the strong drop of temperature

[2] http://essayweb.net

before thunderstorm in summer usually makes people depressed and discomfort.

In this paper, the air pressure is treated as surface pressure and is measured by hPa (hectopascal).

Correlation analysis between weather variables

To clarify the correlation between different weather factors, a simple correlation analysis is applied on three types of weather variables (i.e. Temperature, Cloud Cover rate and Air Pressure). Other weather indicators are exclude since they have been set as dummy variables.

The results are presented as below:

	Temperature	**Cloud Cover Rate**	**Air Pressure**
Temperature	1	-0.224673654	-0.066576349
Cloud Cover Rate	-0.224673654	1	-0.219485226
Air Pressure	-0.066576349	-0.219485226	1

As can be seen from the figure above, the relations among three weather variables represent negative, which reflects the real weather phenomenon. With the temperature become higher, cloud cover rate and air pressure tend to decrease correspondingly. In the same way, with the increase of cloud cover rate, air pressure will decrease.

De-seasonality of the weather variables

Seasonality[3] refers to the fact that some time series display a regular and foreseeable change within every calendar year. The predictable pattern in a time series that repeats or recurs over a one-year period is considered as seasonal, which has important influence while studying the effects of stock return.

[3] http://www.investopedia.com

As can be seen from appendix 1, the trend of temperature and air pressure in the period 2000-2010 shows obvious seasonality effect. The change in the data variables follows a same pattern during each year. Some weather facts of Sweden are presented as below that may partially explain the existence of seasonality effect.

In Sweden, the weather condition varies substantially from the southern to the northern. In the north, where a sub-Arctic climate dominates, winter time is as long as 7 months with frigid temperature. The southern Sweden, on the other hand, enjoys generally temperate climate all the year round with nearly 4 months summer and short and mild winter of about 2 months. Summer in both the north and south is fairly sunny and warm with average maximum temperature 17 C in the north and 20 C in the north. Apart from this, Sweden is relatively cloudy in autumn and winter and rather sunny in spring and summer. Thus, we believe seasonality effect also exists in cloud cover data.

Consider that stocked are traded throughout Sweden although stock exchange is located and the stock returns are recorded in Stockholm, the weather facts are confirmed to be relevant in this paper. Therefore, de-trended proceed is applied to control for the seasonality of these weather data. Following the method applied by previous paper(Lu and Chou(2011)), we plan to de-trend temperature, air pressure and Cloud cover rate. Following the method proposed by Hirshleifer and Shumway (2003), we make weekly moving average rectification in the weather data. i.e. subtract the average of weather variables for those weeks of each year from the original weekly data for de-seasonality. The de-seasonality data are marked by $a'^{d'}$ superscript. The result is presented in appendix 2.

SAD effect

To examine the SAD effect in Sweden, the approach introduced by Kamstra(2003) is

applied to measure SAD based on normalized hours of night.

SAD_t of Stockholm is described as below:

$$SAD_t = \begin{cases} H_t - 12 & For\ trading\ days\ in\ the\ fall\ and\ winter \\ 0 & Otherwise \end{cases}$$

where H_t denotes the length of sun duration at time t.

Assume that SAD_t variables only appear in fall and winter, the seasons that have been proved to affect individual's mood dramatically based on evidences from medical research. The number 12 is the average length of night over the whole year. Thus, SAD_t gives us a prospect about the length of nights in fall and in winter that is associated with the mean value 12 hours.

Considering asymmetry around winter solstice

We expect the investors who are affected by SAD will be more risk averse at the onset of fall, and generally return to "normal" at the end of winter. This evidence implies that returns may be higher in winter and lower in fall.

Following Kamstra(2003)'s finding, a dummy variable is utilized to capture the asymmetry effects in fall relative to that in winter and it represents the days investors suffer from the effects in fall:

$$D_t^{fall} = \begin{cases} 1 & For\ trading\ days\ in\ fall \\ 0 & otherwise \end{cases}$$

Monday effects variable

As a well-acknowledged financial phenomenon, Monday effect has been observed in stock exchanges around the world. It describes the empirical fact that stocks tend to have lower-than-average returns on Mondays compared to other days of the week.

(Scott, D. L. (2003))

To exclude the Monday effect and focus on the relation between weather effects and stock return, a dummy variable is introduced to control for the Monday effect. It is set to 1 on each Monday and 0 otherwise.

3.2 Stock market variables

Daily stock market return (OMX 30) and a list of individual stock returns are collected from DataStream. Limited to the access to the weather data, the sample period from Jan 1st, 2000 to Dec 31st, 2010 is chosen. All data is recorded as the daily closing price and it consists of 2871 observations. Consider that this time period is of pretty extreme market conditions in many ways, in later part of robustness test, the whole period will be divided into three sub-periods so that a clear pattern could be observed to see how is stock return affected by weather factors during volatile period and calm period respectively.

The OMX 30 is a capitalization weighted index, which is comprised by 30 blue-chip stocks listed on the Swedish Exchange market. Being limited by the time and capital size, we choose 24 stocks from OMX 30 as our sample. Then daily log arithmetic returns are calculated by the following equation:

$$r_t = \ln(\frac{p_t}{p_{t-1}}), \text{ for t=1,2,3…T.}$$

where p_t is the current closing price of equity at time t, p_{t-1} is the previous closing price of equity at time t-1.

Separating big-cap and small-cap companies

Considering that the correlation of stock return towards weather factors may be affected by the size of the company, the chosen stocks are separated by market

capitalization into two groups applying the US standard. Under the US standard of deciding size of company, companies that have market cap between $10 billion to $200 billion are considered as big-cap companies, while mid-cap and small-cap companies have market cap ranging from $2 billion to $10 billion and $300 million to $2 billion respectively.[4]

Therefore, the chosen companies on OMX 30 are sorted as two groups and the mid-cap companies and the single small-cap company are combined together as small-cap for simplicity. This is presented in appendix 3.

There has no previous literature been found to separate big-cap and small-cap companies and study the weather effects on them respectively. However, given the larger market position and considerably higher efficiency that is expected to be held by big-cap companies compared with small-cap companies, in this paper, we aim to examine if different pattern will be observed on the relationship between weather factors and big-cap and small-cap companies separately. This gives us the chance to find out if the size of companies is affecting the weather conditions on stock market behaviors to some extent and in which way the size matters.

In our expectation, the effects of weather on big-cap group will be easier and more evident to be captured due to the significant market position; apart from this, we expect a more consistent and obvious pattern for the big-cap group since the higher efficiency and professional of big-cap companies may help them to be influenced less by environmental factors.

[4] http://www.investopedia.com/articles/basics/03/031703

4.Applying Methodology

4.1 Unit root tests

Whether the chosen weather and financial time series have unit roots dominated by stochastic trends, is a key factor to help us deciding which model can be constructed. When the mean and auto-covariance of a series do not rely on time, the series is considered stationary. The weather and financial time series can be utilized to obtain the reasonable test results only if they are stationary.

To test for the stationarity of the weather series, three popular unit root tests are employed: Augmented Dickey-Fuller (ADF) test, Phillips and Perron (PP) test and Kwiatkowski et al. (KPSS) test. By testing for stationarity, null hypothesis that the series has a unit root is rejected at 1% significance level for all the weather series.

Same tests are exercised on the stock series and the result is presented in appendix 4. As can be seen from the table, for all three tests, the null hypothesis that there exists a unit root is rejected at 1% significance level.

Therefore, we conclude that these series are all stationary and therefore can be used for regression analysis. Further, no significant upward or downward trend is discerned in any of the chosen weather series. And also no evidence is observed that the weather of Stockholm is suffering from the global warming effects such as: lower rain precipitation rates and higher temperatures over past 10 years.

4.2 Regression Model

Since each of our data series follows a stationary way, we are supposed to employ the

regression model thereafter. The relationship between stock returns and weather variables can be examined by the traditional cross-sectional regression model, which we consider could provide intuitive, explicit and easily-interpreted result. When we adopt a pooled regression for each stock return, a better outlook for comparison is obtained. The regression model is expressed as below:

$$RET_t = \alpha_0 + \alpha_1 RET_{t-1} + \alpha_2 CC_t^d + \alpha_3 TEMP_t^d + \alpha_4 PRE_t^d + \alpha_5 WIND_t + \alpha_6 SNOW_t + \alpha_7 RAIN_t + \alpha_8 D_t^{Monday} + \alpha_9 SAD_t + \alpha_{10} D_t^{Fall} + \varepsilon_t$$

Where the variables with 'd' superscript are weather variables after de-seasonality. As have been discussed before, SNOW, RAIN and WIND are set as dummy variables; temperature and air pressure are recorded as their real levels; cloud cover is separated as different levels; SAD and fall variables are measured as dummy variables according to Kamstra (2003); D_{monday} is a dummy variable to capture the Monday effect.

5. Empirical Findings and Analysis

5.1 Descriptive statistics

The summary statistics of weather variable is presented in appendix 2. It includes original daily temperature, cloud cover rate and atmospheric pressure. As can be seen from the table, the sample mean of temperature is 5.795749, and the maximum and minimum values are 20.83774 and -17.15298 respectively. The sample mean of atmospheric pressure is 1010.361, and the maximum and minimum values are 1043.041 and 960.8566 respectively. Similarly, the sample mean of cloud cover rate is 0.583775, and the maximum and minimum values are 1 and 0 respectively. The

statistics of skewness, kurtosis and Jarque-Bera tests represent the temperature following a non-normal distribution. Cloud cover rate and atmospheric pressure are also with a non-normal distribution.

Then we consider the descriptive statistics of adjustment weather variables after de-seasonality. After the weekly de-seasonality proceeds, we have approached the true value of weather variables. The sample mean of adjustment daily temperature roams around 0.023706, and the highest temperature is 8.467612 and the lowest temperature is -11.83328. Likewise, the sample mean of adjustment atmospheric pressure is -0.15755, and the highest value is 31.33706 and the lowest value is -45.90914 respectively. The sample mean of adjustment cloud cover rate is 0.000663, and the maximum and minimum values are 0.736458 and -0.827985 respectively. The statistics of skewness, kurtosis and Jarque-Bera tests also indicate that the distributional properties of all three adjustment weather series appear non-normal.

All descriptive statistics of stock market and each stock return are shown in Appendix 5. The sample mean of OMX30 return is -1.28E-05, and the standard deviation is 0.016484. The statistics of kurtosis and skewness indicates the return of stock market follows a non-normal distribution. The Jarque-Bera releases the further evidence that the stock market return does not follow a normal distribution. Based on the same principle, the rest of stock returns are all following a non-normal distribution.

5.2 The effect of weather on market returns

Regarding big-cap companies:

Firstly, we focus on the OMX market. As can be seen from appendix 6, for the sample period Jan 1st, 2000 to Dec 31st,2010, a negative and significant correlation between temperature and OMX return is observed. This indicates that as temperature

decreases, stock returns tend to rise on Swedish stock market in general.

Similar pattern is discerned regarding temperature variable on stock returns of all of the big-cap firms. A negative relation is found between stock returns and level of temperature. Among the big-cap firms, this negative relation is statistically significant for firms as follows: Nordea. Ericssion B. Svenska. Investor B. Assa Abloy B. SEBA.

The negative relation is coincident with previous findings on other stock markets. In our hypothesis, we expect to observe a positive link between temperature and stock returns in Sweden due to the special weather condition. However, the empirical result suggests a negative correlation. Previously, Cao and Wei (2003) have proved that lower and higher temperature both causes aggression, but higher temperature also causes apathy. The mutual effects of aggression and apathy on investors´ behavior offset each other under relatively higher temperature, while the aggression caused by lower temperature remain exist. This temperature evidence can explain the result obtained to a large extent.

We thereby conclude that in Sweden, the lower the temperature, the more it approaches aggression level for individuals. People tend to hold optimistic view on stock market and take on more risky investment as response to lower temperature, which will result in the rise of stock market return. This effect is of more importance considering the opening price of each trading day when people get into working places from outside and when they have been experiencing the outside temperature substantially.

Air pressure appears to be the second important weather factor that affects stock returns of big-cap companies. For both Nordea and Ericssion B, stock return is negatively and significantly related to air pressure, which is opposite to our expectation. As have been discussed in the data description part, lower air pressure is often a prediction of cloudy and rainy weather. According to Saunders (1993),

cloudy weather condition tends to depress the stock market return. Following this argument, lower air pressure, which infers higher cloud cover rate is supposed to cause a decrease in stock return. Therefore, the negative correlation obtained between air pressure and stock returns breaches this conjecture. The explanation of this founding may leave for future studies of the effect of air pressure on investors from both physical and psychological point of view.

Other significant relation have been found as: a negative relation between wind speed and stock return of Swedbank According to Limpaphayom et al. (2005), the higher level of morning wind will reduce investors' trading ability and during the windy days afternoon income would be lower in average. Hence, the result has been corroborated this viewpoint in disguise.

A positive relation between D fall variable and stock return of Assa Abloy B is also found in the result. However, the empirical results show that SAD effect is not an important factor that affect Swedish stock market.

Only Sandvik shows the Monday influence under 5% confidence levels, but when we look at all Monday effects in other stock returns, it is found that most of them show a positive relationship with stock returns. This result is consistent to the concept that Monday has the inactive effects on stock returns.

Regarding small-cap companies:

By looking at the result shown in appendix 6, a different picture is observed for small-cap companies compared to big-cap companies. No clear pattern or trend can be concluded for the small-cap companies. Significant relation has been found between certain stock returns and almost all the weather variables.

Unlike the big-cap group, temperature is no longer the dominant weather effect on stock return since only one significant relation is found between temperature and

stock return of Securitas B. But this relation remains to be negative as has been explained in the previous part.

Air pressure is found to be significantly related to stock return of Swedish Match negatively, which is also consistent with the relation discussed for bid-cap firms. Apart from this, a positive relationship is observed between cloud cover and stock return of MTG B. This result violates the previous founding by Saunders (1993) and Hirshleifer and Shumway (2003), in which studies higher rate of cloud cover is linked to pessimistic mood of investors and depressed stock market returns.

A noticeable result on examining the correlation between weather variables and stock returns of small-cap companies is that small-cap companies tend to react more to extreme weather conditions (i.e. snow and rain) compared to its big-cap counterparts. This result confirms our expectation. For instance, stock return of Astrazeneca and Getinge is significantly and negatively related to snow variable, while MTG B shows a positive relation with snow and a negative relation with rain. This result obtained suggest that these small-cap companies response to extreme weather condition towards non-consistent directions. Consider that no significant relation is found for the big-cap companies, we reckon that the smaller market capitalization and the lack of professional can explain this result to some extent.

Finally, for the company Getinge, negative statistical result of both SAD and D Fall shows that stock return of Getinge is affected by the SAD effect. This result is matching with that have been found by Kamstra (2003). According to Kamstra, stock returns react negatively with SAD effect due to the more risk averse caused by SAD. In general, the SAD effect is not as significant as we expected although the feature of daytime length in Sweden is evident. The non-significant effect of SAD, as far as we concern, may be attributed to the reasons as follows: firstly, being long-time reside in Sweden, local investors´ have been used to the natural phenomenon and they have learnt to cope with the situation related to shortened daytime length in fall and winter,

thereby SAD do not exert dramatic influence on investors´ behavior in practice; secondly, the investors in foreign countries may account for a fairly large position in Swedish stock market, which reduces the effect of SAD.

In general, the results show that the magnitude of regression coefficient is relatively low, which indicates that the multi weather factors and Swedish stock market return do not appear significant relationship.

5.3 Subsamples and Robustness Test

In the last part of this paper, robustness test is applied to test the ability of the model if it can perform effectively under alternation of variables or assumptions. The whole period from Jan 1st 2000 to Dec 31st 2010 is divided into three periods. The periods between 2000-1-3 to 2003-4-30 and between 2007-12-1 to 2010-12-31 are considered as volatile period, while the period from 2003-5-1 to 2007-11-30 is set to be calm period according to the figure of appendix 7.

Volatile period

As can be seen from appendix 8 (period 1), few stock returns are influenced by weather variables. This result can referred to be consistent with the previous research conducted by Yoon and Kang(2009), in which paper they found that the weather effects is weakened dramatically during the Crisis period.

However, by looking at the regression results of period 3 which is shown in appendix 10, a noticeable evidence is observed as the effect of wind plays a dominant position among all the weather factors. Seen from the results, wind speed is affecting five big-size firms and one small-size firm. The coefficients all appears negative, which indicates that the stronger the wind, the lower the stock return.

Calm period

During the calm period, most of the weather variables appear similar to that of whole period and it affects the stock returns more significantly as we expected. Therefore, the weather effects in calm period have more value for investors´ decision making on stock market.

A result that we have to pay attention to is that the influence of wind is totally breaching the theory discussed before. Here the regression coefficients all appear to be positive, which indicates that stock return is rising with the increase of wind speed. To our best knowledge, no previous literature has been found to explain this situation properly. Thereby, we can merely guess that the investors who trading indoor tend to hold more positive mood when the outside is experiencing fairly strong wind. The optimistic mood further contributes to the decision-making process and raise the stock return.

6.Conclusion

In recent years, behavioral finance has been increasingly applied to explain the violations of efficient market hypothesis. The effects of weather, as a significant factor which related to investor sentiment, have been taken into consideration when discussing the stock market return.

There have been a number of studies in this field to investigate the relationship between multi weather factors and stock market in different parts of the world from various perspectives using a range of methods. Motivated by previous studies and considering the special weather condition of Sweden, in this paper, we examined

effects of multi weather factors on Swedish stock market return.

The companies that have been chosen are separated as two groups regarding the market capitalization to explore further the different effects of weather variables on big-cap and small-cap companies. Certainly, our results indicate that relationship between weather variables and stock market is not of substantial significance. However, it does not mean investors do not affected by weather; probably the effect is eliminated by weather mutual function.

Some major results have been discovered:

For the group of big-cap companies, significant negative relations have been found between most of the stock returns and temperature. This can be explained according to previous studies and the result is exactly the same. Taken the special location and weather facts of Sweden into consideration, it is not difficult to relate the lower temperature to risk taking behavior of people. Same pattern is not found for the small-cap companies. Regarding this point, we consider that the appearance of temperature is more salient due to the substantial market shares of the big-cap companies on Swedish stock market.

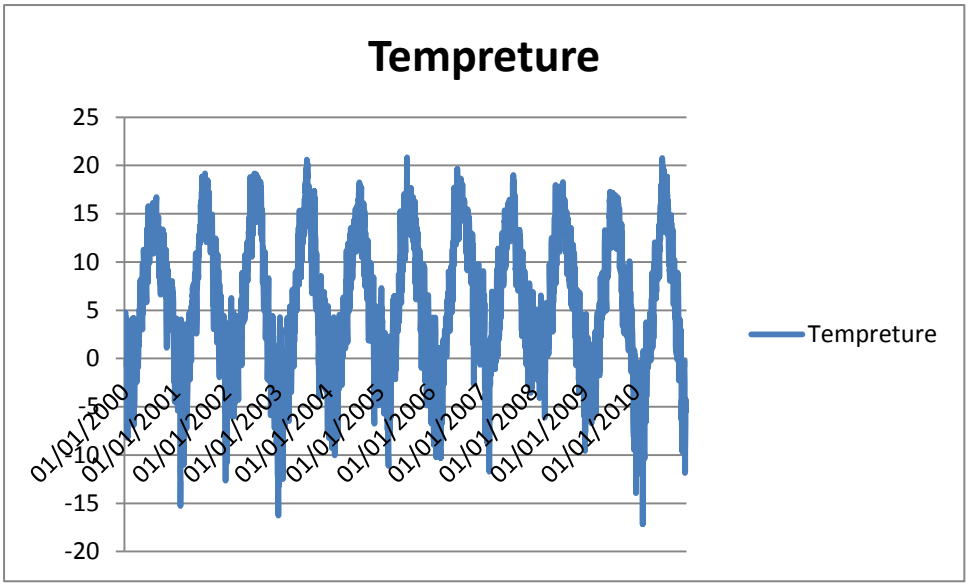
For the group of small-cap companies, it tends to be affected by all the weather variables that have been taken into account. Different from the big-cap companies, where no relation has been found between the stock returns and extreme weather conditions (i.e. snow and rain), small-cap companies display an obvious response to snow and rain variables. Although the results do not give a clear indication about how those stock return move towards these extreme weathers, the volatile and vulnerable fluctuation of stock return due to small size of the companies and the potentially lack of professional can to some extent explain the result obtained.

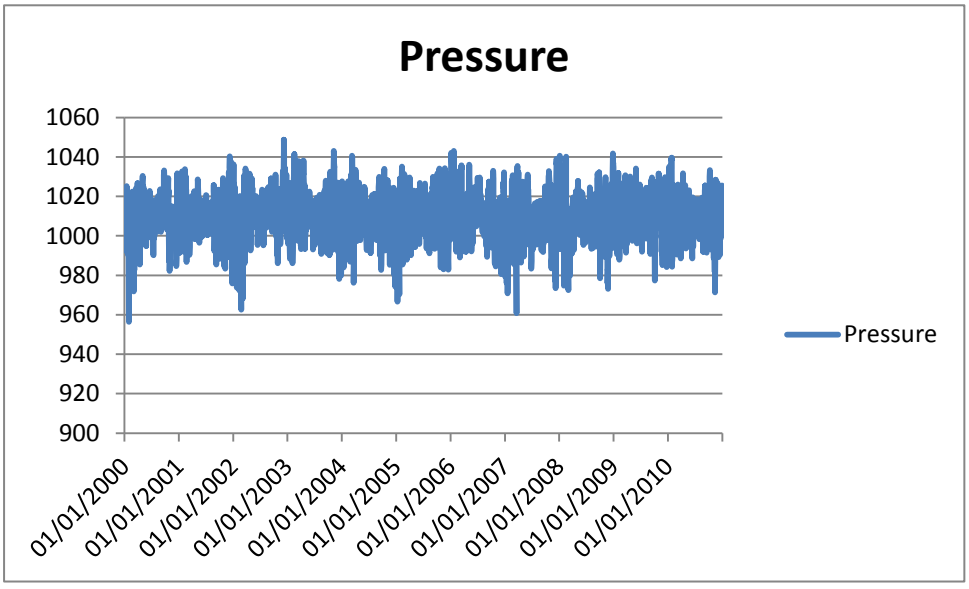
Apart from this, air pressure appears to be negatively related to stock market return, which still calls for deeper studies in the future to explain. The effect of cloud cover and SAD has been confirmed to be consistent with previous studies.

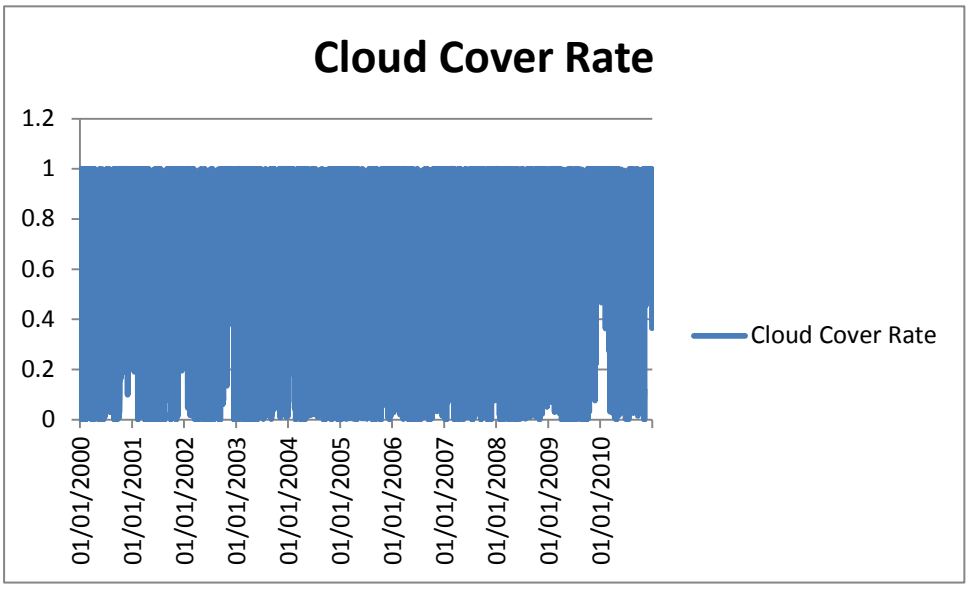
In general, previous studies in this field mostly focus on temperature, cloud cover rate and sunshine variables. At the same time, other variables or combinations of variables could also link to potential similar results. In reality, the weather conditions tend to be inter-linked to each other. Therefore, it is not simple to identify the certain effect of a specific weather variable on the stock market return. For further studies, we expect to develop a method that could model the effect of a particular weather variable to observe a clearer and more explicit relationship between stock market return and weather factors.

Appendix

Appendix 1. Seasonality Effect







Appendix2. De-seasonality of weather data

Panel A: original weather data

	Mean	Maximum	Minimum	Standard Deviation
Variables				
TEMP	5.795749	20.83774	-17.15298	6.82998
PRE	1010.361	1043.041	960.8566	11.41631
CC	0.583775	1	0	0.366154

Panel B: weekly de-seasonalized weather data

	Mean	Maximum	Minimum	Standard Deviation
Variables				
TEMP	0.023706	8.467612	-11.83328	1.970993
PRE	-0.15755	31.33706	-45.90914	7.299461
CC	0.000663	0.736458	-0.827985	0.291011

Appendix 3 Separating big-cap and small-cap companies

Company	Market Capitalization(USD,bn)	Segment
HENNES & MAURITZ	52.83714281	Big
NORDEA BANK	46.8194602	Big
ERICSSON	37.31000513	Big

SVENSKA HANDBKN	27.20714141	Big
ATLAS COPCO	24.46820082	Big
VOLVO	23.75514707	Big
SWEDBANK	23.24782075	Big
SEB	22.86107183	Big
SCA	22.86107183	Big
SANDVIK	20.32910173	Big
ASSA ABLOY	14.10957627	Big
INVESTOR	13.39761021	Big
ABB (OME)	12.50928415	Big
SKF	10.21536119	Big
ATLAS COPCO B	10.15010022	Big
SCANIA	8.266389049	Mid
ELECTROLUX	7.742281337	Mid
ASTRAZENECA (OME)	7.227185854	Mid
SKANSKA	7.115776062	Mid
SWEDISH MATCH	6.801901891	Mid
GETINGE	6.741613189	Mid
TELE2	6.730270211	Mid
BOLIDEN	4.662119117	Mid
SECURITAS	3.313858632	Mid
MODERN TIMES GP.MTG	2.531503955	Mid
SSAB	1.835697748	Small→Mid

Appendix 4 Unit root test

Stock variables

	ADF	PP	KPSS
OMX 30	-54.86059	-55.33078	0.297834
H&M	-52.14598	-53.4853	0.188527
Nordea	-42.03719	-57.70626	0.059591
Ericssion B	-51.22425	-51.17353	0.235983
Svenska	-41.67769	-57.01644	0.042416
Volvo	-51.78431	-51.79161	0.132881
Swedbank A	-55.36463	-55.54237	0.127388
Sandvik	-53.26006	-54.07521	0.150226
Investor B	-53.70623	-54.048	0.155179
Assa Abloy B	-58.24266	-60.17172	0.143673
SEB A	-34.35196	-53.0457	0.105039
ABB	-25.10642	-50.10471	0.311119
SCA B	-54.18156	-54.24634	0.044338

	ADF	PP	KPSS
Swedish Match	-43.32562	-63.45818	0.115333
Tele2 B	-51.8731	-51.8474	0.18738
Astrazeneca	-51.39452	-51.63212	0.047499
Skanska B	-53.73334	-53.79361	0.09248
Electrolux B	-53.45059	-53.91591	0.177961
Scania B	-53.73955	-53.75153	0.219234
Atlas B	-55.56508	-56.80472	0.169758
Getinge	-54.88122	-55.265	0.20624
SSAB A	-54.22605	-54.38161	0.161805
Boliden	-52.0569	-52.11857	0.579381
Securitas B	-53.51999	-55.11918	0.070065
MTG B	-49.43907	-49.43907	0.225746

Weather variables

	ADF	PP	KPSS
Adjustment TEM	-33.79301	-47.61745	0.10203
Adjustment PRE	-31.12333	-35.79839	0.20973
Adjustment CC	-38.7024	-61.74235	0.26943

Appendix 5 Descriptive statistics of stock returns

	No. of observations	Mean	Standard deviation	Maximum	Minimum	Skewness	Kurtosis	Jarque-Bera
OMX 30	2870	-1.28E-05	0.016484	0.09865	-0.085269	0.124386	6.133163	1181.316***
H&M	2870	0.000158	0.021200	0.155935	-0.353105	-1.559378	34.98746	123520.5***
Nordea	2870	0.000213	0.023027	0.149127	-0.122137	0.329630	7.970244	3006.08***
Ericssion B	2870	-0.000642	0.034132	0.223144	-0.273893	-0.402761	10.70422	7175.461***
Svenska	2870	0.000243	0.01953	0.132861	-0.107399	0.25032	8.592084	3769.511***
Sandvik	2870	0.000328	0.022087	0.132035	-0.160989	0.041476	7.139819	2050.254***
Volvo	2870	0.000385	0.022366	0.151281	-0.153768	0.016872	6.864161	1785.724***
Investor B	2870	6.33E-05	0.018917	0.136412	-0.108894	0.101491	6.910596	1833.686***
Swedbank A	2870	-3.40E-05	0.025136	0.173578	-0.205377	-0.172551	11.82945	9336.868***
Skanska B	2870	0.000181	0.020892	0.156004	-0.205669	-0.282704	10.91628	7532.223***
Assa Abloy B	2870	0.000165	0.024405	0.158576	-0.18352	0.098868	7.73147	2681.764***
SEB A	2870	8.17E-05	0.027284	0.232148	-0.22322	0.109873	12.69722	11250.93***
ABB	2870	-8.22E-05	0.035145	0.359855	-0.923686	-6.223936	176.9833	3638339***

	No. of observations	Mean	Standard deviation	Maximum	Minimum	Skewness	Kurtosis	Jarque-Bera
Getinge	2870	0.000639	0.019215	0.116072	-0.167538	-0.005664	7.047122	1958.695***
Astrazeneca	2870	-4.42E-05	0.017599	0.120974	-0.125066	-0.09534	7.912247	2889.914***
Atlas B	2870	0.000545	0.025409	0.165891	-0.176312	0.17228	7.175205	2098.814***
SCA B	2870	8.17E-05	0.016998	0.113807	-0.12944	0.109121	8.474331	3589.405***
SSAB A	2870	0.000368	0.024957	0.150152	-0.168867	-0.222181	8.365764	3466.587***
Boliden	2870	-0.000164	0.034697	0.277542	-0.219041	0.118347	9.498533	5056.815***
Securitas B	2870	-4.94E-05	0.022584	0.146297	-0.152314	0.004423	9.115783	4472.761***
Tele2 B	2870	-0.000108	0.0247	0.128506	-0.165241	-0.105747	6.65219	1600.41***
MTG B	2870	6.14E-05	0.030013	0.189209	-0.292657	-0.185215	9.833518	5600.589***
Scania B	2870	0.000284	0.020738	0.125726	-0.122997	0.192161	7.702174	2661.703***
Electrolux B	2870	0.000208	0.024708	0.191834	-0.207986	0.102718	9.07209	4414.118***
Swedish Match	2870	0.000663	0.016626	0.103231	-0.079553	0.113213	5.720405	891.1199***

Appendix 6. Regression results for whole period

Big-size firms:

Regression of big size firms for whole period group 1

	OMX 30	H&M	Nordea	Ericssion B	Svenska	Volvo	Swedbank A
R_{t-1}	-0.026196	0.02575	-0.053907***	0.042566**	-0.054567	0.031886*	-0.034654
S.E.	0.018714	0.018693	0.018674	0.018689	0.018698	0.018692	0.018686
CC^d	4.60E-05	0.000182	1.01E-05	-0.000884	-0.000165	0.000821	-0.000133
S.E.	0.00038	0.000488	0.000529	0.000785	0.00045	0.000515	0.000579
$TEMP^d$	-0.00043**	-9.04E-05	-0.000824***	-0.001043***	-0.000362*	-1.19E-05	-0.000388
S.E.	0.000173	0.000222	0.000241	0.000358	0.000205	0.000235	0.000264
PRE^d	-6.92E-05	-1.65E-06	-0.000121*	-0.000267***	-8.94E-05	-4.09E-06	-9.45E-05
S.E.	4.64E-05	5.97E-05	6.47E-05	9.59E-05	5.49E-05	6.30E-05	7.07E-05
WIND	-0.000104	-0.000401	-0.00081	0.000535	-0.001296	-0.000596	-0.002052**
S.E.	0.000669	0.00086	0.000932	0.001381	0.000791	0.000907	0.001019
SNOW	0.000599	0.001378	0.000169	0.0006	0.001135	0.002103	-0.000603
S.E.	0.001008	0.001295	0.001405	0.00208	0.001192	0.001366	0.001535
RAIN	-0.000408	0.000489	0.000389	-0.002207	-0.000538	0.000657	0.000389
S.E.	0.000722	0.000928	0.001007	0.001492	0.000854	0.00098	0.0011
D Monday	0.000586	0.000501	-5.86E-05	0.000189	0.000748	0.000112	0.000751
S.E.	0.00077	0.00099	0.001074	0.001592	0.000911	0.001045	0.001174
SAD	-3.76E-05	-6.73E-05	9.11E-06	-3.66E-05	0.000105	1.06E-06	9.51E-05
S.E.	1.34E-04	0.000172	0.000187	0.000276	0.000158	0.000181	0.000204
D Fall	5.47E-05	-0.000499	0.000185	0.000244	0.0008	-6.73E-05	0.000568

S.E.	0.000839	0.001079	0.00117	0.001734	0.000993	0.001138	0.001279
Intercept	-0.000325	-0.000899	0.000415	0.001199	0.001698	-0.001298	0.001558
S.E.	0.001021	0.001313	0.001423	0.00211	0.001208	0.001385	0.001556
Durbin-h	2.001398	1.992543	2.009981	1.995257	2.005914	1.999733	2.002268
R-Square	0.003705	0.002345	0.008047	0.008035	0.006799	0.00419	0.004738
No.of obs.	2869	2869	2869	2869	2869	2869	2869

Regression of big size firms for whole period group 2

	Sandvik	Investor B	Assa Abloy B	SEB A	ABB	SCA B
R_{t-1}	0.006002	-0.004611	-0.086032***	0.0285	0.064106***	-0.011441
S.E.	0.018682	0.018737	0.018631	0.018706	0.01869	0.018683
CC	-0.000491	-0.000243	-0.000561	-0.000356	-0.000526	-0.000421
S.E.	0.000509	0.000436	0.00056	0.000629	0.000809	0.000392
TEMP	0.000212	0.000343*	0.000531**	0.000596**	0.000203	0.00029
S.E.	0.000232	0.000199	0.000255	0.000286	0.000369	0.000179
PRE	3.54E-05	6.59E-05	4.20E-05	0.000107	2.57E-05	6.63E-05
S.E.	6.22E-05	5.33E-05	6.85E-05	7.68E-05	9.89E-05	4.79E-05
WIND	0.000822	0.000797	0.000507	0.001471	-0.000314	-8.12E-05
S.E.	0.000895	0.000768	0.000986	0.001106	0.001425	0.00069
SNOW	-0.000114	7.08E-05	-0.000187	0.000803	-0.001829	-0.000589
S.E.	0.001349	0.001157	0.001486	0.001668	0.002147	0.001039
RAIN	-0.000199	-0.000106	2.24E-05	0.000507	0.0009	0.000475
S.E.	0.000967	0.000829	0.001065	0.001195	0.001538	0.000745
D Monday	-0.002781***	-0.000452	0.000616	-0.001346	-0.000334	-0.000996
S.E.	0.001032	0.000885	0.001136	0.001275	0.001641	0.000795
SAD	0.000143	5.99E-05	-4.16E-05	0.000231	0.00014	8.43E-05
S.E.	0.000179	0.000154	0.000197	0.000221	0.000285	0.000138
D Fall	0.000366	-0.00023	-0.002774**	0.001084	-4.30E-06	-0.000272
S.E.	0.001124	0.000964	0.001239	0.001389	0.001788	0.000866
Intercept	0.001697	0.000564	0.000725	0.00107	0.001973	0.001363
S.E.	0.001367	0.001173	0.001506	0.001689	0.002176	0.001053
Durbin-h	1.998025	1.997992	2.002843	1.996466	1.99942	1.998996
R-Square	0.004117	0.002131	0.011093	0.004324	0.005047	0.002905
No.of obs.	2869	2869	2869	2869	2869	2869

Small-size firms:

Regression of small size firms for whole period group 1

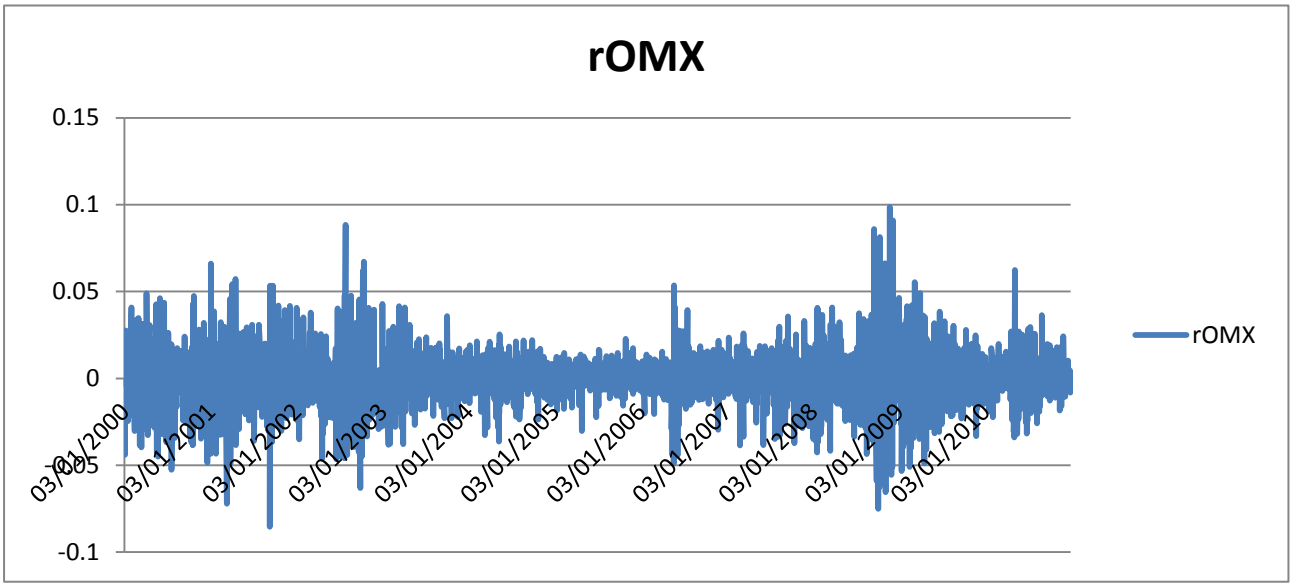
	Swedish Match	Tele2 B	Astrazeneca	Skanska B	Electrolux B	Scania B
R_{t-1}	-0.125545***	0.030074	0.041058**	-0.004705	0.000874	-0.004053
S.E.	0.018555	0.018722	0.018661	0.018703	0.018724	0.018707
CC	0.000487	-0.000496	0.000318	-0.000157	-0.000543	-0.000586
S.E.	0.00038	0.000569	0.000405	0.000482	0.00057	0.000478
TEMP	1.04E-04	-5.90E-05	0.000103	0.000432**	0.000153	0.000157
S.E.	0.000173	0.000259	0.000185	0.00022	0.00026	0.000218
PRE	0.0000884*	-5.39E-05	1.60E-05	3.67E-05	7.21E-05	6.03E-07
S.E.	4.65E-05	6.97E-05	4.95E-05	5.89E-05	6.96E-05	5.85E-05
WIND	0.000647	0.000452	0.00039	0.00016	0.001012	0.00013
S.E.	0.00067	0.001002	0.000713	0.000848	0.001003	0.000842
SNOW	0.000176	-0.001307	0.002353**	-0.000431	-0.001206	-0.001259

S.E.	0.001009	0.001509	0.001074	0.001277	0.001511	0.001268
RAIN	-3.54E-05	0.000627	-0.000535	-5.57E-06	0.001082	0.000204
S.E.	0.000723	0.001082	0.00077	0.000916	0.001083	0.00091
D Monday	0.000226	0.000273	6.31E-05	-0.000896	-0.001172	-0.000777
S.E.	0.000772	0.001155	0.000821	0.000977	0.001156	0.00097
SAD	3.02E-05	0.000126	-4.56E-05	6.46E-05	0.000184	2.90E-05
S.E.	1.34E-04	0.0002	0.000143	0.00017	0.000201	0.000168
D Fall	-0.000238	-0.001102	0.000532	-0.000544	0.000302	-0.000308
S.E.	0.00084	0.001258	0.000895	0.001064	0.001259	0.001057
Intercept	-0.001597	0.001668	-0.001237	0.000846	0.00129	0.001104
S.E.	0.001023	0.00153	0.001089	0.001295	0.001531	0.001286
Durbin-h	2.018429	1.995414	1.996023	2.00106	1.997847	2.000598
R-Square	0.017643	0.002648	0.004906	0.002229	0.00215	0.001538
No.of obs.	2869	2869	2869	2869	2869	2869

Regression of small size firms for whole period group 2

	Atlas B	Getinge	SSAB A	Boliden	Securitas B	MTG B
R_{t-1}	-0.038332**	-0.026411	-0.01559	0.025547	0.000755	0.078721***
S.E.	0.018693	0.018679	0.018717	0.018701	0.018708	0.018645
CC^d	0.000519	-0.00038	0.000153	0.001137	9.63E-05	0.001291*
S.E.	0.000585	0.000443	0.000575	0.000799	0.000521	0.000689
$TEMP^d$	-0.000265	-0.000278	-0.000286	-0.000469	-0.000394*	-0.000262
S.E.	0.000267	0.000202	0.000262	0.000364	0.000237	0.000314
PRE^d	-5.12E-05	-5.47E-06	3.76E-05	-6.74E-05	-6.79E-06	-5.99E-05
S.E.	7.15E-05	5.41E-05	7.03E-05	9.77E-05	6.36E-05	8.43E-05
WIND	0.000192	-0.000539	-0.00073	-0.000599	0.000158	-0.000715
S.E.	0.00103	0.000779	0.001012	0.001406	0.000917	0.001213
SNOW	0.00211	-0.002351**	0.001076	0.002984	-0.00045	0.003361*
S.E.	0.001553	0.001173	0.001525	0.002118	0.001381	0.001828
RAIN	-0.000156	0.000559	0.000987	0.000415	-0.000147	-0.002281*
S.E.	0.001113	0.000841	0.001094	0.001519	0.000991	0.001311
D Monday	-0.000255	0.000754	0.00038	-0.001439	0.001297	-0.001177
S.E.	0.001187	0.000898	0.001166	0.001621	0.001056	0.001398
SAD	-4.13E-06	-0.000384**	-0.000215	-0.000252	-0.000145	-4.36E-05
S.E.	0.000206	0.000156	0.000202	0.000281	0.000183	0.000243
D Fall	0.001046	-0.001993**	-0.001077	-0.000574	7.66E-05	0.001021
S.E.	0.001294	0.000384	0.00127	0.001765	0.001151	0.001523
Intercept	-0.000851	-0.000903	-0.001598	-0.003774*	-0.001487	-0.001285
S.E.	0.001574	0.00119	0.001546	0.002148	0.0014	0.001853
Durbin-h	2.000778	2.000973	1.998801	1.997905	2.000896	1.999775
R-Square	0.003331	0.004855	0.003224	0.005007	0.001898	0.009906
No.of obs.	2869	2869	2869	2869	2869	2869

Appendix 7. Dividing periods for robustness test



Appendix 8. Regression results for period 1 (Robustness test)

Big-size firms:

Regression of big size firms for period 1 group 1

	OMX 30	H&M	Nordea	Ericssion B	Svenska	Volvo	Swedbank A
Rt-1	-0.008203	0.074793**	-0.06844	0.052952	-0.0173	0.023301	-0.038747
S.E.	0.034335	0.034155	0.034219	0.034167	0.0345	0.034202	0.034427
CC	-0.000459	-4.12E-05	-0.001357	-0.001653	-0.00105	0.0008	-0.000744
S.E.	0.00084	0.001241	0.001069	0.00205	0.0008	0.000872	0.000818
TEMP	-0.000626	0.000181	-0.000706	-0.002926***	-0.00047	0.00025	5.30E-05
S.E.	0.000382	0.000563	0.000486	0.000936	0.00036	0.000396	0.000371
PRE	-0.000125	-1.50E-05	-8.52E-05	-0.00067**	-1.33E-05	6.81E-05	1.12E-05
S.E.	0.000112	0.000165	0.000142	0.000272	0.00011	0.000116	0.000109
WIND	0.000346	-0.002686	0.00025	0.002741	-0.00133	0.00136	-0.001774
S.E.	0.001495	0.002215	0.001904	0.003647	0.00142	0.001553	0.001457
SNOW	0.001568	0.00258	0.00277	0.000315	0.0008	0.00219	0.001996
S.E.	0.002262	0.003336	0.002881	0.00551	0.00215	0.002348	0.002198
RAIN	-0.001935	0.001537	0.00117	-0.004726	-0.00019	-0.000435	-0.000977
S.E.	0.001708	0.00252	0.002173	0.004163	0.00162	0.001773	0.001662
D Monday	0.000261	0.000826	7.81E-05	-0.003111	-0.00095	-0.000304	-0.000992
S.E.	0.00174	0.00257	0.002217	0.004244	0.00166	0.001807	0.001698
SAD	-2.08E-05	4.32E-05	0.00025	-0.000171	0.0002	-5.63E-05	0.000118
S.E.	0.000296	0.000438	0.000377	0.000722	0.00028	0.000308	0.000288
D Fall	0.002135	0.00087	0.00179	0.005527	0.0011	0.00285	0.003132*
S.E.	0.001947	0.002872	0.002477	0.004748	0.00185	0.002022	0.001893

Intercept	-0.000396	-0.000297	0.00235	-0.00135	0.0039	-0.003405	0.002531
S.E.	0.002278	0.003364	0.002899	0.00556	0.00216	0.002368	0.002215
Durbin-h	1.998432	1.983005	2.004455	1.991244	1.98868	2.000943	2.009764
R-Square	0.007925	0.010011	0.01113	0.024046	0.00918	0.009224	0.008432
No.of obs.	867	867	867	867	867	867	867

Regression of big size firms for period 1 group 2

	Sandvik	Investor B	Assa Abloy B	SEB A	ABB	SCA B
Rt-1	0.011673	0.040436	-0.068678**	-0.00809	0.072691**	-0.00547
S.E.	0.034169	0.034524	0.034144	0.0344	0.03415	0.034147
CC	0.0007	-0.000434	0.000928	0.00027	0.0004	0.00033
S.E.	0.0009	0.000906	0.001242	0.001068	0.002205	0.000744
TEMP	-0.000136	-0.000428	-0.000737	-0.000548	-0.000163	-0.000183
S.E.	0.000409	0.000411	0.000564	0.000485	0.001001	0.000338
PRE	-5.08E-05	-7.64E-05	-1.16E-05	-5.65E-05	-0.000262	-9.61E-05
S.E.	0.00012	0.000121	0.000165	0.000142	0.000293	9.89E-05
WIND	-0.002412	-0.000231	-0.00103	-0.001757	-5.56E-07	-0.001259
S.E.	0.001603	0.001611	0.00221	0.001902	0.003925	0.001324
SNOW	0.00124	-0.000778	0.000331	0.00108	0.00664	0.00166
S.E.	0.002421	0.002437	0.003345	0.002875	0.005942	0.002001
RAIN	-0.002057	3.47E-05	-0.003121	-0.002638	-0.007681*	-0.002122
S.E.	0.001828	0.00184	0.002523	0.002171	0.004485	0.001512
D Monday	-0.00248	0.000405	-0.002129	0.00073	-0.000458	4.74E-05
S.E.	0.001866	0.001876	0.002572	0.002214	0.004571	0.001541
SAD	8.59E-07	-8.94E-05	0.00027	-0.000106	-0.000402	5.09E-05
S.E.	0.000317	0.000319	0.000438	0.000376	0.000777	0.000262
D Fall	0.00396*	0.001936	0.006581**	0.00169	0.00448	0.00407**
S.E.	0.002087	0.002097	0.002882	0.002473	0.005113	0.001725
Intercept	-0.000748	-0.001191	0.001064	0.0003	-0.004302	0.00045
S.E.	0.002439	0.002459	0.003365	0.002895	0.005978	0.002016
Durbin-h	1.994821	1.996892	2.005986	1.996154	2.008322	1.992091
R-Square	0.009763	0.005573	0.015938	0.005324	0.011801	0.009643
No.of obs.	867	867	867	867	867	867

Small-size firms:

Regression of small size firms for period 1 group 1

	Swedish Match	Tele2 B	Astrazeneca	Skanska B	Electrolux B	Scania B
Rt-1	-0.126313***	0.091233***	0.090646***	0.027634	0.024709	0.042483
S.E.	0.033832	0.034212	0.034115	0.034187	0.03414	0.034294
CC	-0.000535	0.000362	0.000824	-0.000231	-0.000495	-1.44E-05
S.E.	0.000788	0.001345	0.000905	0.000933	0.001108	0.000704
TEMP	0.000181	0.000417	-9.07E-05	-0.000791*	0.000201	-0.000376
S.E.	0.000358	0.000611	0.000411	0.000423	0.000503	0.00032
PRE	-2.26E-05	-8.32E-06	-5.32E-05	4.97E-05	-0.000163	2.36E-05
S.E.	0.000105	0.000179	0.00012	0.000124	0.000147	9.35E-05
WIND	-0.000199	-0.001425	-0.000618	3.76E-05	-0.002007	0.000439
S.E.	0.001402	0.002395	0.001611	0.001659	0.001973	0.001253
SNOW	-0.002188	0.003528	-0.002316	0.002101	0.002482	0.002667
S.E.	0.002119	0.003619	0.002433	0.002512	0.002983	0.001893
RAIN	0.001344	-0.00153	-0.000381	-0.00148	-0.004363*	-0.001916
S.E.	0.001601	0.002735	0.001838	0.001898	0.002253	0.001439
D Monday	-0.00201	0.000756	-0.000377	0.000949	0.002803	-0.000964
S.E.	0.001632	0.002788	0.001874	0.001931	0.002302	0.001458
SAD	-0.000215	-0.000242	-6.44E-05	0.00013	-0.000342	8.89E-05
S.E.	0.000278	0.000475	0.000319	0.000328	0.000391	0.000248
D Fall	-0.001564	0.00373	0.00123	0.00249	0.002505	0.004319
S.E.	0.001824	0.003116	0.002096	0.002159	0.002568	0.001634
Intercept	0.000675	-0.003218	-0.001213	0.000493	-0.00051	-0.000302
S.E.	0.002136	0.003649	0.002452	0.002528	0.003005	0.001908
Durbin-h	2.009575	1.993741	1.971974	2.005559	1.996094	2.006083
R-Square	0.021419	0.014065	0.011467	0.011431	0.009906	0.017886
No.of obs.	867	867	867	867	867	867

Regression of small size firms for period 1 group 2

	Atlas B	Getinge	SSAB A	Boliden	Securitas B	MTG B
Rt-1	-0.037755	-0.009622	-0.083021**	0.075591**	0.022873	0.081055**
S.E.	0.034187	0.034194	0.034153	0.034206	0.034223	0.034193
CC	0.000334	-0.001315	-0.001906**	0.002064	0.000373	0.00174
S.E.	0.001169	0.000883	0.000883	0.001587	0.00122	0.001673
TEMP	0.000185	-0.000423	0.000576	0.00035	-0.000353	-0.000114
S.E.	0.000531	0.000401	0.000401	0.000721	0.000554	0.00076
PRE	-8.33E-05	-8.96E-06	0.000114	-3.55E-05	8.62E-05	-3.01E-05
S.E.	0.000155	0.000117	0.000118	0.000211	0.000162	0.000223
WIND	-0.000611	-0.000309	-0.001264	-0.002414	-0.000505	0.00081

S.E.	0.002081	0.001573	0.001572	0.002827	0.002172	0.002983
SNOW	0.001923	-0.003376	0.002431	0.00334	0.000872	0.00744*
S.E.	0.003153	0.002378	0.002376	0.004269	0.003285	0.00451
RAIN	-0.00022	0.001325	0.001065	-0.004155	-0.002478	-0.005377
S.E.	0.002376	0.001799	0.001797	0.003226	0.002482	0.003402
D Monday	-0.002134	0.000333	-0.002039	-0.002705	0.000683	0.00082
S.E.	0.002421	0.001831	0.00183	0.003296	0.002526	0.003468
SAD	9.33E-05	-0.000508	2.15E-05	-0.000595	-1.59E-05	-0.000225
S.E.	0.000412	0.000312	0.000311	0.000561	0.00043	0.00059
D Fall	0.004862*	-0.000795	0.003249	0.001784	0.00171	0.00438
S.E.	0.002713	0.002046	0.002046	0.003676	0.002825	0.003876
Intercept	-0.000782	-0.000779	0.002393	-0.007835*	-0.00036	-0.006097
S.E.	0.003169	0.002395	0.002396	0.004322	0.003305	0.004544
Durbin-h	1.994256	1.993725	1.987828	2.004688	2.000156	2.002925
R-Square	0.007665	0.009144	0.0207	0.013238	0.004344	0.015895
No.of obs.	867	867	867	867	867	867

Appendix 9. Regression results for period 1 (Robustness test)

Big-size firms:

Regression of big size firms for period 2 group 1

	OMX 30	H&M	Nordea	Ericssion B	Svenska	Volvo	Swedbank A
Rt-1	-0.069159**	-0.082924***	-0.105554***	0.007129	-0.077087***	-0.047882*	-0.081055***
S.E.	0.028948	0.028928	0.028775	0.02906	0.02889	0.029028	0.028942
CC	0.00023	0.000201	0.000696	-0.000181	1.31E-05	0.000834	0.000387
S.E.	0.000373	0.000455	0.000486	0.000814	0.000429	0.000597	0.0005
TEMP	-0.000371**	-0.000274	-0.000908***	-0.000302	-0.000326	-0.00044	-0.000394*
S.E.	0.000174	0.000213	0.000227	0.00038	0.0002	0.000279	0.000234
PRE	-6.00E-05	5.53E-05	-0.000105	-0.000139	-8.01E-05	-3.85E-05	-0.000118*
S.E.	4.49E-05	5.48E-05	5.84E-05	9.78E-05	5.16E-05	7.18E-05	6.01E-05
WIND	0.001138	0.001386*	0.001012	0.001029	0.001238	0.000273	0.00012
S.E.	0.000672	0.00082	0.000877	0.001466	0.000773	0.001075	0.000901
SNOW	-0.001013	-0.000676	-0.000379	-0.000452	-0.000297	0.000319	-0.000237
S.E.	0.001064	0.001299	0.001388	0.002322	0.001224	0.001702	0.001428
RAIN	7.21E-05	0.000644	-0.000248	-0.001034	0.000289	0.000635	-0.000859
S.E.	0.0007	0.000854	0.000912	0.001526	0.000804	0.001119	0.000938
D Monday	0.000538	0.000219	0.000282	0.002033	0.001707*	-0.000128	4.44E-05
S.E.	0.000767	0.000936	0.001	0.001673	0.000882	0.001226	0.001028
SAD	-6.50E-05	-0.000201	-7.11E-05	0.000138	-8.16E-06	4.23E-05	-3.45E-05
S.E.	0.000137	0.000167	0.000179	0.000299	0.000158	0.000219	0.000184
D Fall	-0.000659	-0.001063	0.00065	-0.002449	0.000675	-0.000703	0.00146
S.E.	0.000849	0.001036	0.001106	0.001853	0.000976	0.001358	0.001138
Intercept	-0.000548	-0.001748	-0.001303	0.002235	-0.000909	-0.000163	-0.000258
S.E.	0.000991	0.001209	0.001291	0.002161	0.00114	0.001585	0.001328
Durbin-h	1.999217	1.999673	2.009548	1.991201	2.009835	1.998238	2.007775
R-Square	0.011694	0.013533	0.025776	0.007316	0.015033	0.007001	0.013646
No.of obs.	1196	1196	1196	1196	1196	1196	1196

Regression of big size firms for period 2 group 2

	Sandvik	Investor B	Assa Abloy B	SEB A	ABB	SCA B
Rt-1	-0.043977	-0.064381**	-0.100184***	-0.085081***	-0.022169	-0.037861
S.E.	0.028938	0.029024	0.028884	0.028926	0.029123	0.028968
CC	-0.000254	0.000568	-8.74E-05	0.000424	3.50E-05	0.000376
S.E.	0.000575	0.000531	0.000643	0.000544	0.000778	0.000414
TEMP	-0.000435	-0.00022	-0.000525*	-0.000653**	-0.000422	-0.000456**
S.E.	0.000269	0.000248	0.0003	0.000254	0.000362	0.000193
PRE	-9.95E-05	-9.27E-05	-4.31E-05	-9.57E-05	1.19E-05	-7.92E-05
S.E.	6.91E-05	6.37E-05	7.73E-05	6.54E-05	9.33E-05	4.97E-05
WIND	0.001262	-0.000155	0.001618	0.001945**	0.002169	0.001901**
S.E.	0.001035	0.000955	0.001158	0.00098	0.0014	0.000745
SNOW	-0.002994*	-0.001903	-1.95E-05	-0.001754	-0.004254*	-0.001882
S.E.	0.001639	0.001512	0.001834	0.001551	0.002214	0.001183
RAIN	0.000492	4.15E-05	0.000999	-0.000427	0.001871	0.000403
S.E.	0.001077	0.000994	0.001205	0.00102	0.001455	0.000775
D Monday	0.002723**	-0.000266	-0.000808	0.000253	0.000517	0.000825
S.E.	0.001182	0.00109	0.001322	0.001118	0.001594	0.00085
SAD	-0.000272	-0.000217	-2.28E-05	-0.000215	-0.000197	-0.000154
S.E.	0.000211	0.000195	0.000236	0.0002	0.000285	0.000152
D Fall	-0.002308*	-0.001476	0.00149	-0.000299	-0.002332	-0.000901
S.E.	0.001308	0.001206	0.001463	0.001237	0.001765	0.000941
Intercept	-0.001024	-0.000791	-0.00107	-0.001999	-0.000509	-0.002335**
S.E.	0.001526	0.001408	0.001707	0.001444	0.002063	0.001099
Durbin-h	2.002416	1.995246	2.000006	2.00051	2.000564	2.00424
R-Square	0.013378	0.009513	0.01619	0.01691	0.006978	0.014742
No.of obs.	1196	1196	1196	1196	1196	1196

Small-size firms:

Regression of small size firms for period 2 group 1

	Swedish Match	Tele2 B	Astrazeneca	Skanska B	Electrolux B	Scania B
Rt-1	-0.060492*	-0.032247	0.020363	-0.074909***	-0.05099	0.007453
S.E.	0.029088	0.029137	0.0291	0.028992	0.029073	0.029091
CC	0.000259	0.000182	-0.000462	0.000109	0.000503	0.00113*
S.E.	0.00047	0.000615	0.000489	0.000583	0.000683	0.000592
TEMP	-0.000118	-0.000176	0.000202	-0.000301	-0.000604*	-0.000343
S.E.	0.00022	0.000287	0.000228	0.000272	0.00032	0.000276
PRE	-0.000105*	3.89E-05	1.30E-06	-7.98E-05	-0.000134	-5.41E-05
S.E.	5.65E-05	7.42E-05	5.88E-05	7.00E-05	8.21E-05	7.11E-05
WIND	-0.000191	0.001563	0.000561	0.000863	0.001019	0.00058
S.E.	0.000846	0.001108	0.000881	0.00105	0.00123	0.001066
SNOW	0.002153	-0.000842	-0.001411	-0.001895	0.001246	6.83E-05
S.E.	0.001341	0.001754	0.001395	0.001662	0.001948	0.001688
RAIN	-0.000547	-0.000499	0.000126	0.000529	-0.000445	-3.98E-06
S.E.	0.000882	0.001153	0.000917	0.001092	0.001281	0.001109
D Monday	0.000131	-0.000569	-0.000947	0.000348	-0.001144	0.00092
S.E.	0.000966	0.001264	0.001005	0.001198	0.001404	0.001216
SAD	0.000155	-9.05E-05	4.68E-05	-0.000144	-0.000305	-7.59E-05
S.E.	0.000173	0.000226	0.00018	0.000214	0.000251	0.000217
D Fall	0.001239	0.000319	-0.00185*	-0.000429	-0.002119	-0.001314
S.E.	0.001069	0.001399	0.00018	0.001325	0.001555	0.001346
Intercept	0.00123	-0.000851	0.001546	-0.000729	-0.002337	-0.001375
S.E.	0.001248	0.001632	0.001299	0.001547	0.001813	0.001572
Durbin-h	2.008375	1.998055	1.996669	2.004891	2.000101	1.99255
R-Square	0.009547	0.004287	0.007734	0.008779	0.01196	0.006709
No.of obs.	1196	1196	1196	1196	1196	1196

Regression of small size firms for period 2 group 2

	Atlas B	Getinge	SSAB A	Boliden	Securitas B	MTG B
Rt-1	-0.058822	-0.068951**	-0.028939	0.012796	-0.045578	0.031649
S.E.	0.02897	0.029076	0.028962	0.02901	0.029011	0.029073
CC	0.000257	7.80E-05	0.001016	-0.000232	-1.35E-05	0.00079
S.E.	0.000688	0.000551	0.000688	0.000927	0.000656	0.000716
TEMP	-0.000567*	-0.000243	-0.000488	-0.000826*	-0.000468	-0.000291
S.E.	0.000321	0.000257	0.000321	0.000434	0.000306	0.000335
PRE	-6.65E-05	1.70E-05	1.22E-05	-0.00017	-7.98E-05	-0.000119
S.E.	8.27E-05	6.61E-05	8.26E-05	0.000111	7.88E-05	8.62E-05
WIND	0.002409*	0.000458	0.002211*	0.003182*	0.001556	0.00016
S.E.	0.001239	0.00099	0.001239	0.001669	0.001181	0.001291
SNOW	-0.001115	-0.001642	-0.001366	0.002008	-0.001452	-0.000614
S.E.	0.001962	0.001568	0.001961	0.002643	0.001871	0.002045
RAIN	9.84E-05	0.000778	0.000645	0.002643	-0.000304	-0.00139
S.E.	0.00129	0.00103	0.001289	0.001738	0.00123	0.001343
D Monday	-0.000352	0.000366	0.001407	0.000414	0.001942	-0.002663*
S.E.	0.001414	0.00113	0.001414	0.001904	0.001349	0.001472
SAD	-6.86E-05	-0.000247	-0.000217	0.000103	-0.000329	-0.000109
S.E.	0.000253	0.000202	0.000253	0.00034	0.000241	0.000263
D Fall	-0.001293	-0.001524	-0.002277	-0.000292	-0.000758	0.00036
S.E.	0.001565	0.00125	0.001565	0.002108	0.001492	0.001629
Intercept	-0.000434	-0.000865	-0.002644	-0.000529	-0.002698	0.00042
S.E.	0.001827	0.001462	0.001825	0.00246	0.001742	0.001902
Durbin-h	2.004394	2.008728	2.005149	2.00476	2.002584	1.997813
R-Square	0.00907	0.008322	0.009737	0.011047	0.009141	0.007058
No.of obs.	1196	1196	1196	1196	1196	1196

Appendix 10. Regression results for period 3 (Robustness test)

Big-size firms:

Regression of big size firms for period 3 group 1

	OMX 30	H&M	Nordea	Ericssion B	Svenska	Volvo	Swedbank A
Rt-1	-0.038263	-0.044359	-0.029379	-0.004965	-0.07398**	0.069013*	-0.029426
S.E.	0.035487	0.035645	0.035432	0.035443	0.035473	0.035428	0.035485
CC	0.000384	0.000271	0.000313	-0.001072	0.00034	0.00093	-0.000214
S.E.	0.000879	0.000911	0.001379	0.001213	0.001259	0.001375	0.001814
TEMP	-0.000357	-0.000143	-0.000849	-0.000127	-0.000307	0.00031	-0.000913
S.E.	0.000381	0.000394	0.000597	0.000525	0.000545	0.000596	0.000785
PRE	-5.42E-05	-9.32E-05	-0.000178	-0.000127	-0.000188	-1.73E-05	-0.00013
S.E.	9.92E-05	0.000103	0.000156	0.000137	0.000142	0.000155	0.000205
WIND	-0.002347	-8.65E-05	-0.00452**	-0.002701	-0.004885**	-0.003815*	-0.005259*
S.E.	0.001448	0.0015	0.002272	0.001996	0.002073	0.002264	0.002988
SNOW	0.001712	0.002975	-0.000893	0.001815	0.00344	0.00443	-0.002599
S.E.	0.002061	0.002137	0.00323	0.002834	0.002953	0.003218	0.004254
RAIN	-0.000171	-0.001068	0.000231	-0.003454	-0.001765	0.00089	0.003687
S.E.	0.001583	0.00164	0.002486	0.002182	0.002267	0.002476	0.003265
D Monday	0.00111	0.000846	-0.000895	0.000768	0.00096	0.00062	0.003827
S.E.	0.00168	0.001739	0.002637	0.002315	0.002405	0.002626	0.003467
SAD	-0.00011	-3.38E-05	-0.00016	-0.000363	0.00019	-8.06E-05	0.000309
S.E.	0.000289	0.000299	0.000454	0.000398	0.000415	0.000452	0.000598
D Fall	-0.00132	-0.001919	-0.002308	-0.001923	0.00047	-0.00233	-0.003723
S.E.	0.001765	0.001827	0.00277	0.002434	0.002529	0.00276	0.003642
Intercept	-0.000316	-9.76E-05	0.001138	0.002101	0.00344	-0.000897	0.003097
S.E.	0.002359	0.002441	0.003704	0.003255	0.003377	0.003689	0.00488
Durbin-h	1.998197	1.992707	2.005506	1.991828	2.002323	1.983113	2.000434
R-Square	0.010201	0.008214	0.012317	0.008525	0.016895	0.015622	0.016167
No.of obs.	804	804	804	804	804	804	804

Regression of big size firms for period 3 group 2

	Investor B	Assa Abloy B	SEB A	ABB	SCA B
Rt-1	-0.017746	-0.10765***	0.067133*	0.082307**	-0.012716
S.E.	0.035569	0.035274	0.035426	0.035376	0.035448
CC	0.000373	0.001576	0.000485	0.001258	0.000674
S.E.	0.000959	0.00118	0.001844	0.001143	0.001016
TEMP	-0.000469	-0.000433	-0.000703	-7.64E-05	-0.000258
S.E.	0.000415	0.000511	0.000798	0.000495	0.00044
PRE	-4.34E-05	-9.38E-05	-0.000155	8.47E-05	-3.14E-05
S.E.	0.000108	0.000133	0.000208	0.000129	0.000115
WIND	-0.002389	-0.002862	-0.005882*	-0.002322	-0.001024
S.E.	0.001579	0.001944	0.003036	0.001882	0.001673
SNOW	0.002813	-0.00014	-0.000953	0.004144	0.002436
S.E.	0.002248	0.00276	0.004325	0.002682	0.002376
RAIN	-9.41E-05	0.00126	0.001099	0.000266	-0.000534
S.E.	0.001726	0.002125	0.003319	0.00206	0.001831
D Monday	0.001524	0.001367	0.003893	0.001946	0.002666
S.E.	0.001832	0.002255	0.003525	0.002184	0.001941
SAD	0.000108	-0.000173	-0.00042	-0.000181	-0.000183
S.E.	0.000316	0.000388	0.000607	0.000377	0.000334
D Fall	0.000283	0.001122	-0.004726	-0.002067	-0.001833
S.E.	0.001927	0.002371	0.003702	0.002295	0.00204
Intercept	0.000524	-0.00307	-0.001641	-0.003073	-0.002205
S.E.	0.002572	0.003167	0.004949	0.003068	0.002726
Durbin-h	1.996123	1.99516	1.989091	1.981245	1.993878
R-Square	0.009472	0.019823	0.016483	0.019838	0.007914
No.of obs.	804	804	804	804	804

Small-size firms:

Regression of small size firms for period 3 group 1

	Swedish Match	Tele2 B	Astrazeneca	Skanska B	Electrolux B	Scania B
Rt-1	-0.176433***	-0.048814	-0.029292	0.005809	0.006525	-0.036136
S.E.	0.034916	0.035521	0.035258	0.035578	0.035622	0.035529
CC	-0.001747**	0.001255	-0.001471*	0.000656	0.002126	0.000509
S.E.	0.000827	0.001121	0.000802	0.001144	0.001353	0.001318
TEMP	-0.000333	4.20E-06	-0.000509	-0.000278	-0.000119	0.0003
S.E.	0.000358	0.000485	0.000348	0.000495	0.000585	0.00057
PRE	-0.0001	0.000116	5.90E-06	-8.08E-05	8.96E-05	2.91E-05
S.E.	9.32E-05	0.000126	9.05E-05	0.000129	0.000153	0.000149
WIND	-0.001682	-0.002202	-0.001861	-0.001654	-0.002791	-0.001697
S.E.	0.001361	0.001846	0.001323	0.001884	0.002226	0.00217
SNOW	-0.00074	0.002139	-0.00374*	0.001307	0.000303	0.001482

S.E.	0.001934	0.002626	0.001877	0.002676	0.003163	0.003086
RAIN	0.000114	-0.000375	0.00183	0.00044	0.000952	0.000798
S.E.	0.001491	0.002017	0.001446	0.002059	0.002433	0.002372
D Monday	0.000932	-0.000618	0.001669	0.001543	0.003445	0.002458
S.E.	0.001579	0.002142	0.001534	0.002185	0.002581	0.002518
SAD	1.57E-05	-5.73E-05	0.000204	-0.000273	7.34E-05	-0.000165
S.E.	0.000272	0.000369	0.000264	0.000376	0.000444	0.000433
D Fall	0.000833	-0.000707	-1.83E-05	-0.00041	-0.000207	-0.001422
S.E.	0.00166	0.002251	0.001612	0.002297	0.002713	0.002646
Intercept	0.00366*	-0.001201	0.004059*	-0.002869	-0.001805	-0.001976
S.E.	0.002218	0.003007	0.002154	0.003069	0.003624	0.003534
Durbin-h	2.031879	1.989961	2.01526	1.992621	1.991193	1.996363
R-Square	0.041965	0.008279	0.02497	0.005343	0.009469	0.005463
No.of obs.	804	804	804	804	804	804

Regression of small size firms for period 3 group 2

	Atlas B	Getinge	SSAB A	Boliden	Securitas B	MTG B
Rt-1	-0.03222	-0.017154	0.010783	-0.02497	0.002418	0.083704**
S.E.	0.035467	0.035574	0.035542	0.035496	0.035493	0.035338
CC	0.001298	-0.000229	0.001367	0.00289	0.000165	0.00153
S.E.	0.001378	0.001002	0.001576	0.001891	0.0009	0.001327
TEMP	-0.000504	-0.000163	-0.001123	-0.001006	-0.000383	-0.000386
S.E.	0.000596	0.000434	0.000682	0.000819	0.00039	0.000575
PRE	-5.88E-06	-2.90E-05	4.00E-05	-3.43E-06	5.44E-06	-2.74E-05
S.E.	0.000155	0.000113	0.000178	0.000214	0.000102	0.00015
WIND	-0.001836	-0.002271	-0.003989	-0.003515	-0.000923	-0.003722*
S.E.	0.002267	0.001651	0.002594	0.003113	0.001482	0.002186
SNOW	0.005606	-0.001425	0.003025	0.00369	-0.000816	0.00453
S.E.	0.003222	0.002346	0.003691	0.004432	0.002107	0.00311
RAIN	-0.00113	-0.000759	0.001075	0.00045	0.002447	-0.001853
S.E.	0.002478	0.001806	0.00284	0.003404	0.001621	0.002388
D Monday	0.002359	0.001339	0.001718	-0.002315	0.000893	-0.000804
S.E.	0.002629	0.001918	0.003009	0.003613	0.00172	0.002534
SAD	-0.000141	-0.000427	-0.000576	-0.000579	-6.49E-05	2.80E-05
S.E.	0.000453	0.00033	0.000518	0.000622	0.000296	0.000437
D Fall	-0.000151	-0.003875*	-0.004045	-0.003736	-0.000344	-0.001977
S.E.	0.002764	0.002014	0.003162	0.003796	0.001808	0.002664
Intercept	-0.002269	-0.000496	-0.005518	-0.00606	-0.001544	0.00071
S.E.	0.003692	0.002689	0.004226	0.005071	0.002415	0.003566
Durbin-h	1.997283	2.004238	1.99403	1.999683	1.993071	1.994826
R-Square	0.010352	0.009059	0.017063	0.013018	0.006101	0.019719
No.of obs.	804	804	804	804	804	804

References

Cao, M., & Wei, J. (2005). Stock market returns: A note on temperature anomaly. *Journal of Banking & Finance*, *29*(6), 1559-1573.

Cunningham, M. R. (1979). Weather, mood, and helping behavior: Quasi experiments with the sunshine samaritan. *Journal of Personality and Social Psychology*, *37*(11), 1947.

Daniel, K., Hirshleifer, D., & Subrahmanyam, A. (1998). Investor psychology and security market under‐and overreactions. The Journal of Finance, 53(6), 1839-1885.

DeGennaro, R. P., Kamstra, M. J., & Kramer, L. A. (2008). Does risk aversion vary during the year? Evidence from bid-ask spreads. *Evidence from Bid-Ask Spreads (November 2008)*.

Etzioni, A. (2010). *Moral Dimension: Toward a New Economics*. Free Press.

Forgas, J. P., Goldenberg, L., & Unkelbach, C. (2009). Can bad weather improve your memory? An unobtrusive field study of natural mood effects on real-life memory. *Journal of Experimental Social Psychology*, *45*(1), 254-257.

Hirshleifer, D., & Shumway, T. (2003). Good day sunshine: Stock returns and the weather. *The Journal of Finance*, *58*(3), 1009-1032.

Howarth, E., & Hoffman, M. S. (1984). A multidimensional approach to the relationship between mood and weather. *British Journal of Psychology*, *75*(1), 15-23.

Hirshleifer, D. (2001). Investor psychology and asset pricing. *The Journal of Finance*, *56*(4), 1533-1597.

Isen, A. M. 1993. Positive affect and decision making.Handbook of Emotion (p. 261-277).

Joshi, N., & Bhattarai, R. (2010). Stock Returns and Economically Neutral Behavioural Variables: Evidence from the Nepalese Stock Market. Economic Review Occasional Paper, (19), 43-58.

Kamstra, M. J., Kramer, L. A., & Levi, M. D. (2002). Losing sleep at the market: The daylight saving anomaly: Reply. *The American Economic Review*, *92*(4), 1257-1263.

Kamstra, M. J., Kramer, L. A., & Levi, M. D. (2003). Winter blues: A SAD stock market cycle. *The American Economic Review*, *93*(1), 324-343.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica: Journal of the Econometric Society*, 263-291.

Krämer, W., & Runde, R. (1997). Stocks and the weather: An exercise in data mining or yet another capital market anomaly?. *Empirical Economics*, *22*(4), 637-641.

Keef, S. P., & Roush, M. L. (2002). The weather and stock returns in New Zealand. *Quarterly Journal of Business and Economics*, 61-79.

Keef, S.P. and Roush, M.L. (2007). The day-of-the-week Effect in the Australian Stock Market. International Journal of Business and Management.

Little, A. C., & Hancock, P. J. (2002). The role of masculinity and distinctiveness in judgments of human male facial attractiveness. *British Journal of Psychology*, *93*(4), 451-464.

Lu, J., & Chou, R. K. (2012). Does the weather have impacts on returns and trading activities in order-driven stock markets? Evidence from China. *Journal of Empirical Finance*, *19*(1), 79-93.

Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological bulletin*, *127*(2), 267.

Limpaphayom, P., Locke, P. R., & Sarajoti, P. (2005). Gone with the Wind: Chicago's Weather and Futures Trading. *Unpublished working paper, Chulalongkorn University*.

Markowitz, H. (1952). Portfolio selection*. *The journal of finance*, *7*(1), 77-91.

Molin, E., Oppewal, H., & Timmermans, H. (1996). Predicting consumer response to new housing: A stated choice experiment. *Netherlands Journal of Housing and the Built Environment*, *11*(3), 297-311.

Mehra, R., & Sah, R. (2002). Mood fluctuations, projection bias, and volatility of equity prices. *Journal of Economic Dynamics and Control*, *26*(5), 869-887.

Nelson, S. A. (1904). *The ABC of options and arbitrage* (Vol. 6). SA Nelson.

Romer, P. M. (2000). Thinking and feeling. *The American Economic Review*, *90*(2), 439-443.

Redelmeier, D. A., & Baxter, S. D. (2009). Rainy weather and medical school admission interviews. *Canadian Medical Association Journal*, *181*(12), 933-933.

Saunders, E. M. (1993). Stock prices and Wall Street weather. *The American Economic Review*, *83*(5), 1337-1345.

Sanders, J. L., & Brizzolara, M. S. (1982). Relationships between weather and mood. *The Journal of General Psychology*, *107*(1), 155-156.

Sharpe, W. F. (1964). Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk*. *The journal of finance*, *19*(3), 425-442.

Stathopoulos, T. (2009). Wind and comfort. In *Proceedings of European–African Conference on Wind Engineering (EACWE 5), International Association for Wind Engineering, Florence Italy*.

Symeonidis, L., Daskalakis, G., & Markellos, R. N. (2010). Does the weather affect stock market volatility?. *Finance Research Letters*, *7*(4), 214-223.

Schwarz, N., & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of personality and social psychology*, *45*(3), 513.

Schwarz, N. (1990). Feelings as information: Information and motivational functions of affective states. *Handbook of motivation and cognition*, *2*, 527-561.

Scott, D. L. (2003). *Wall Street words: an A to Z guide to investment terms for today's investor*. Houghton Mifflin Harcourt.

Tufan, E., & Hamarat, B. (2004). Do cloudy days affect stock exchange returns: Evidence from Istanbul stock exchange. *Journal of Naval Science and Engineering*, *2*(1), 117-126.

Yoon, S. M., & Kang, S. H. (2009). Weather effects on returns: Evidence from the Korean stock market. *Physica A: Statistical Mechanics and its Applications*, *388*(5), 682-690.